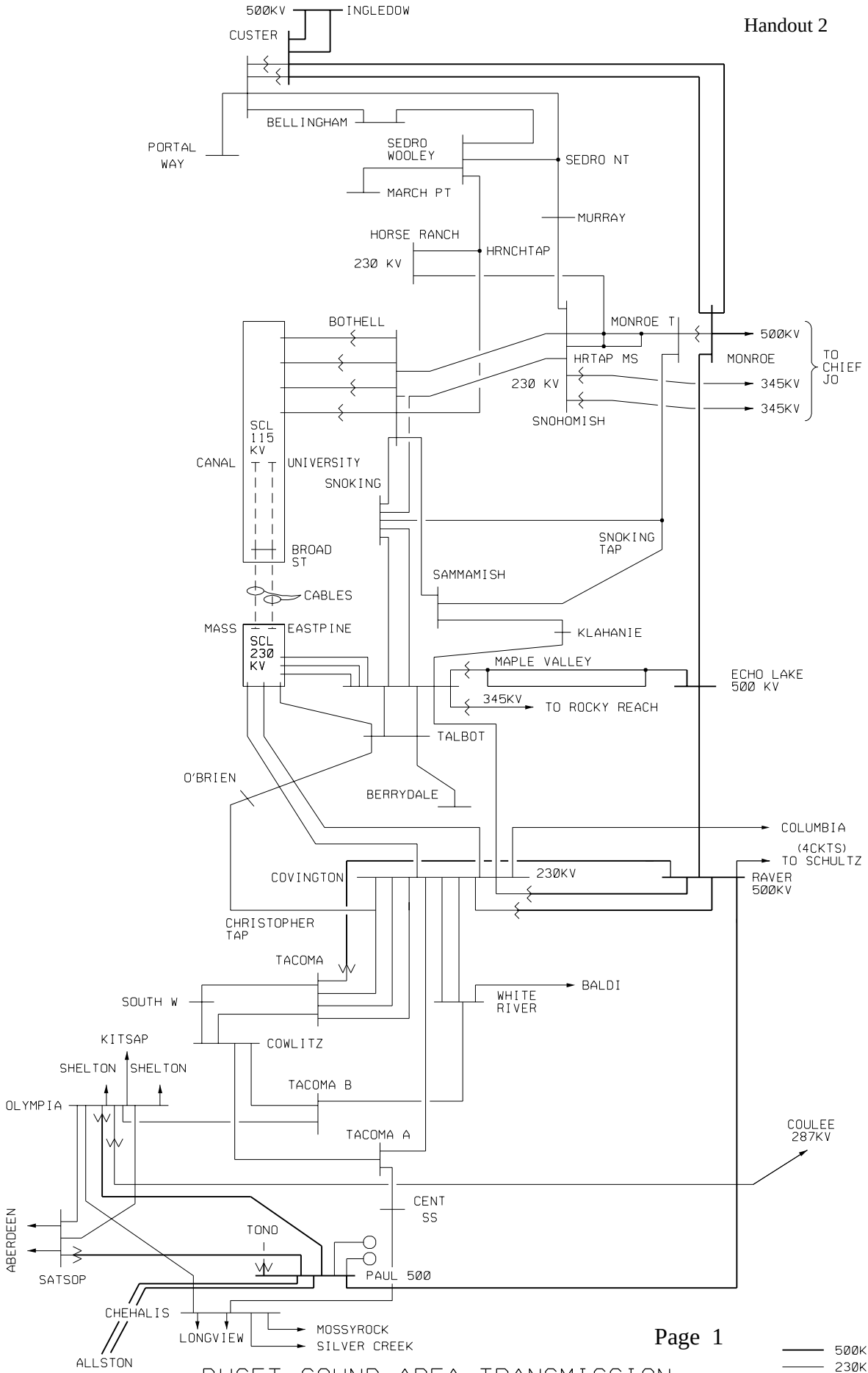


PUGET SOUND AREA TRANSMISSION

List of the First 12 Options Considered

GROUP 1—With 2 Maple Valley-Snoking-Bothell 230 kV lines

OPTION

1. Raver-Echolake 500 kV line #2, Snoking 500/230 kV,
2. Echolake-Schultz 500 kV, Snoking 500/230 kV,
3. Raver-Echolake 500 kV line #2, Snoking 500/230 kV transformer, Monroe-Echolake 500 kV line.
4. Echolake-Schultz 500 kV, Snoking 500/230 kV transformer and Monroe-Echolake 500 kV line.

GROUP 2—With One Maple Valley-Snoking-Bothell 230 kV line

OPTION

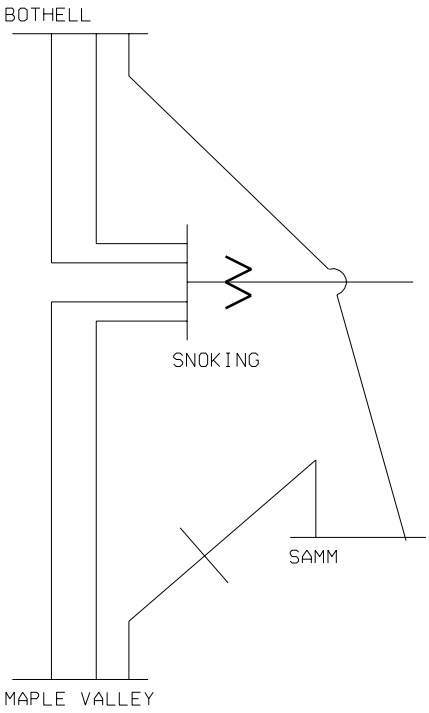
1. Raver-Echolake 500 kV line #2, Snoking 500/230 kV
2. Echolake-Schultz 500 kV, Snoking 500/230 kV,
3. Raver-Echolake 500 kV line #2, Snoking 500/230 kV transformer, Monroe-Echolake 500 kV line.
4. Echolake-Schultz 500 kV, Snoking 500/230 kV transformer and Monroe-Echolake 500 kV line.

GROUP 3—With One Maple Valley-Bothell 230 kV

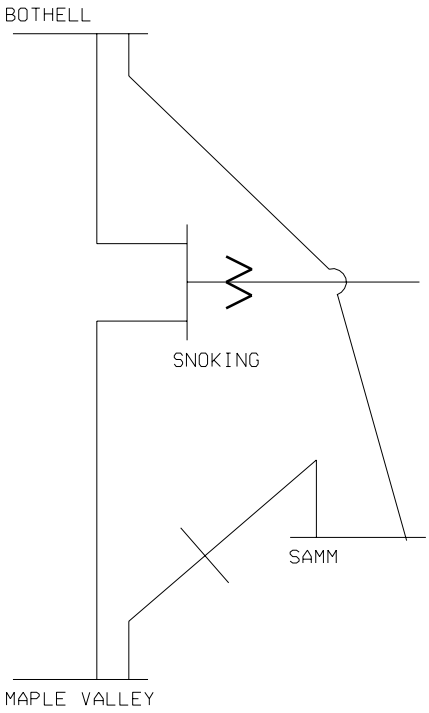
OPTION

1. Raver-Echolake 500 kV line #2, Snoking 500/230 kV,
2. Echolake-Schultz 500 kV, Snoking 500/230 kV transformer
3. Raver-Echolake 500 kV line #2, Snoking 500/230 kV transformer, Monroe-Echolake 500 kV line.
4. Echolake-Schultz 500 kV, Snoking 500/230 kV transformer and Monroe-Echolake 500 kV line.

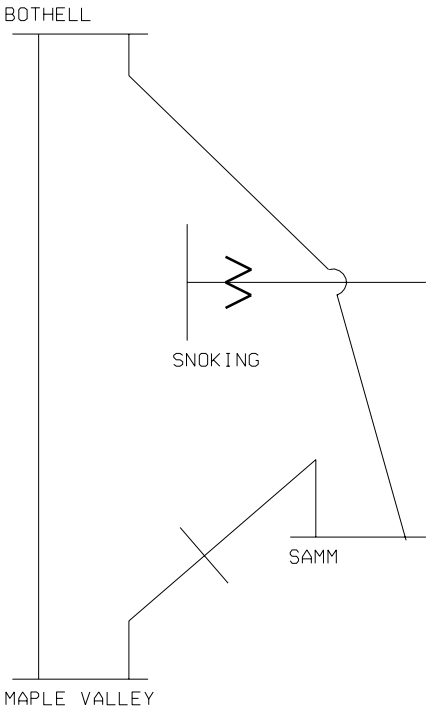
GROUP 1



GROUP 2



GROUP 3



RAVER-ECHO LAKE 500 KV #2 vs SCHULZ-ECHO LAKE 500 KV

		RAVER-EL #2	**SCHULTZ-EL**
	GROUP	OPTION 1	OPTION 2
NEXT TX ADDITION	1	J 2009	J 2010
	GROUP	OPTION 1	OPTION 2
QV MVAR MARGIN	1	173 @ 1.045	248 @ 1.045
2006 EH (Chief Joe-Monroe 500 Outage)		RAVER 500	RAVER 500
NW LOSSES (WINTER) - MW		1415/1468	1410/1466
NI@ 1270/1700 MW S-N			
PAUL-RAVER LOADING (MW)	GROUP	OPTION 1	OPTION 2
AT 2850 MW N-S	1	1730	1687
(P1150/S100/SN40)	2	1732	1697
	3	1733	1693
# OF BREAKERS REQUIRED		3	2
MILES OF NEW LINE		11.9 MI	9.5 MI
COST (LINE)		$12,900,000	$11,300,000
COST (SUBSTATION)		$8,160,000	$6,480,000

NORMAL WINTER 2006
GROUP 1 TO 3 COMPARISON

	2 MV-SK-BOTH GROUP 1 GENERATION		1 MV-SK-BOTH GROUP 2 GENERATION		1 MV-BOTH GROUP 3 GENERATION	
	600/400/125	300/200/60	600/400/125	300/200/60	600/400/125	300/200/60
FACILITIES	CUS-ING	CUS-ING	CUS-ING	CUS-ING	CUS-ING	CUS-ING
ADDED	LIMIT-MW	LIMIT-MW	LIMIT-MW	LIMIT-MW	LIMIT-MW	LIMIT-MW
SUMMARY WITH SCHULTZ-ECHO LAKE OPTION 2 & 4 + VARIATIONS						
	(Option 2)					
SCH-EL 500	**1588**	**0**	0	0	1193	738
SK 500/230 TX						
	(Option W1)					
SCH-EL 500	**>1700 (1835)**	**1392**	883	489	1285	712
SK 500/230 TX			**(37/38)**	**(33/34)**		
BOTH-SAMM LOOP						
	(Option 4)					
SCH-EL 500	>1700	0		Base Case OL	>1700	>1700
SK 500/230 TX	**(9/10)**					
EL-MON #2						
SCH-EL 500			>1700	>1700		
SK 500/230 TX			**(39/40)**	**(35/36)**		
EL-MON #2						
BOTH-SAMM LOOP						
			(Option W2)		**(Option W3)**	
SCH-EL 500	N/A	N/A	**1758**	**1264**	**>1700**	**1625**
SK 500/230 TX						
BOTH-SAMM LOOP						
MV-BOTH #2						
SCH-EL 500	N/A	N/A			>1700	1521
SK 500/230 TX						
MV-BOTH #2						
SCH-EL 500			882	463	1289	737
SK 500/230 TX						
BOTH-SAMM LOOP						
SK-BEV 230						
SCH-EL 500			813			
SK 500/230 TX						
3RD SCL CABLE, OH CLOSED						
SCH-EL 500			880			
SK 500/230 TX						
BOTH-SAMM LOOP						
3RD SCL CABLE, OH CLOSED						
SCH-EL 500			1870			
SK 500/230 TX						
SK-BEV 230						

Handout 2

PUGET SOUND AREA
LONG RANGE STUDY - TRANSFER SUMMARY

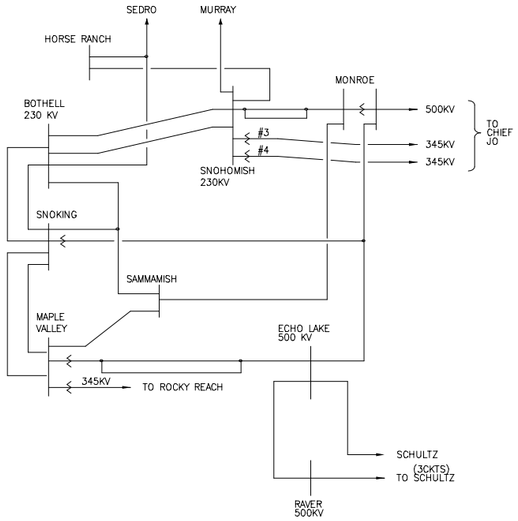
Energization Assumptions	Schultz-EchoLake 500: November 2002 Snoking 500/230 Tx: November 2002		EH WINTER (S-N)	WINTER (S-N)		SPRING (S-N)	SUMMER (N-S)	
OPTIONS	**FACILITIES REQUIRED**	PSE/SCL/SPD GENERATION	950/520/125	600/400/125	300/200/60	260/100/40	1150/650/125	1150/100/40
		REFERENCE TRANSFER LEVEL	700/1270	1270/1700	1270/1700	1370/1800	2350/2850	2350/2850
			TRANSFER DETERMINED BY INTERPOLATION. SOME OPTIONS MAY HAVE ADDITIONAL CAPABILITY.					
			INGLEDOW-CUSTER FLOW					
			(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
W1	2-Maple Valley-Snoking-Bothell 230		**1270**	**1700**	**1344 (pf)**	**1797**	**2850**	**2850**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN29 J06EHSN30	J06SN165 J06SN166	J06SN171 J06SN172	W1SPG01 W1SPG02	W1S01 W1S02	A6NSW11B A6NSW12B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Bothell-Sammamish 230 loop-in at Snoking. Tapping the Bothell-Sammamish 230 into Snoking Sec. 2 is preferable.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
W2	1-Maple Valley-Snoking-Bothell 230		**1270**	**1700**	**1256 (pf)**	**1797**	**2850**	**2850**
	1-Maple Valley-Bothell 230							
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN31 J06EHSN32	J06SN167 J06SN168	J06SN173 J06SN174	W2SPG01 W2SPG02	W2S01 W2S02	A6NSW21B A6NSW22B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Bothell-Sammamish 230 loop-in at Snoking. Tapping the Bothell-Sammamish 230 into Snoking Sec. 2 is preferable.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
W3	2-Maple Valley-Bothell 230		**1270**	**1700**	**1487 (pf)**	**1797**	**2850**	**2762**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN33 J06EHSN34	J06SN169 J06SN170	J06SN175 J06SN176	W3SPG01 W3SPG02	W3S01 W3S02	A6NSW31B A6NSW32B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Bothell-Sammamish 230 loop-in at Snoking. Tapping the Bothell-Sammamish 230 into Snoking Sec. 2 is preferable.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
W4	1-Maple Valley-Bothell 230		**1270** [12]	**1509** [7,8]	**821**	**1352** [10]	**2850** [11]	**2151** [9]
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN44 J06EHSN45	J06SN183 J06SN184	J06SN185 J06SN186	W4SPG01 W4SPG02	W4S01 W4S02	A6NSW42B A6NSW41B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	No Bothell-Sammamish 230 loop-in at Snoking.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Build 12.9 mi new single circuit 230-kV from Snoking Tap to Snoking (energization: 11/02)							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							

Notes: Ambient Temperatures: -15 deg C (estimated)/-5 deg C/20 deg C/30 deg C

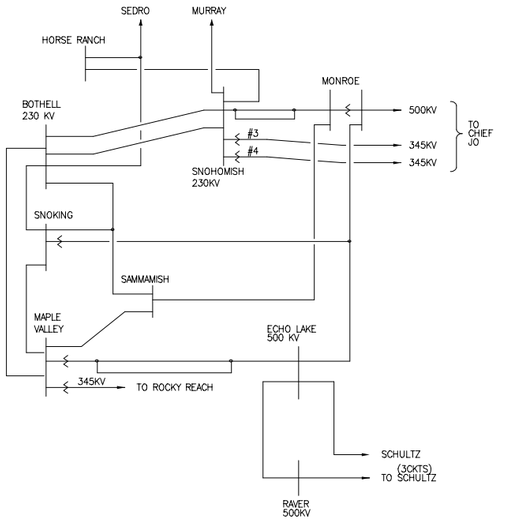
1. March PT-Pethcorn 115 @ 1190/1080/917/800 Amps (75 deg C MOT).
2. Monroe-Monroe Tap 230 @ 3000/3000/2780/2590 Amps (100 deg C MOT).
3. Monroe 500/230 Tx @ 1488/1488 (@ 0.80 L.F.)/1299/1299 MVA
4. Lakeside-Talbot #1 and #2 115 @ 1193/1080 (est.)/917/800 Amps (75 deg C MOT).
5. Cottage Brook-Duval-Stillwater-Novelty-Tolt 115 @ 479/446 (est.)/372/329 Amps (75 deg C MOT).
6. L/D Snok TP 500 and Monroe-Sammamish 230 outage considered non-credible.
7. There may be thermal overloads on Snohomish Co. PUD 115-kV lines. Not sensitive to NI transfers.
8. Need to resolve Snohomish 115 east-bus outage. Snohomish PUD may sectionalize.
9. Snok TP 500 and Snok TP 230 double line loss considered non-credible. If Bothell-Diablo #3 is looped into Snohomish NI limit would be 2585 MW.
10. Assumes Fall City-Tolt 115 kV line is upgraded. (If not upgraded the NI limit would be 1302 MW).
11. Loading on Bothell-Snohomish 230 kV line #2 is 99% for an outage.
12. Talbot Tx overloaded beyond emergency rating for bus outages at Maple Valley. Not sensitive to NI transfers.

PUGET SOUND AREA
LONG RANGE STUDY - TRANSFER SUMMARY

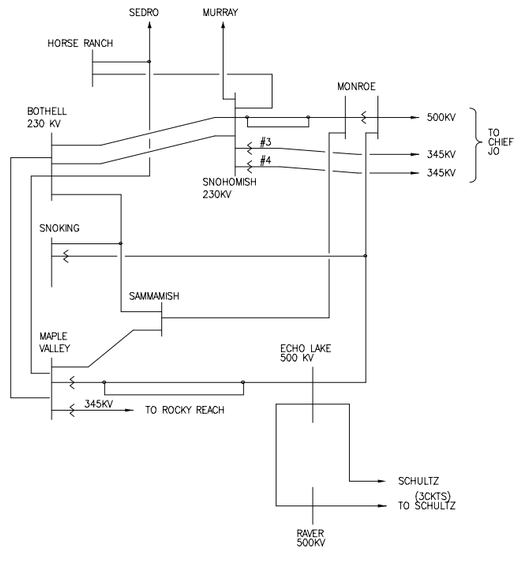
OPTION W1



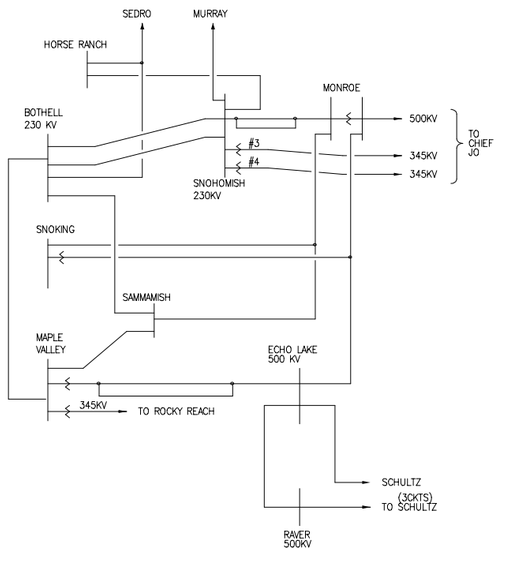
OPTION W2



OPTION W3



OPTION W4



PUGET SOUND AREA
LONG RANGE STUDY - TRANSFER SUMMARY

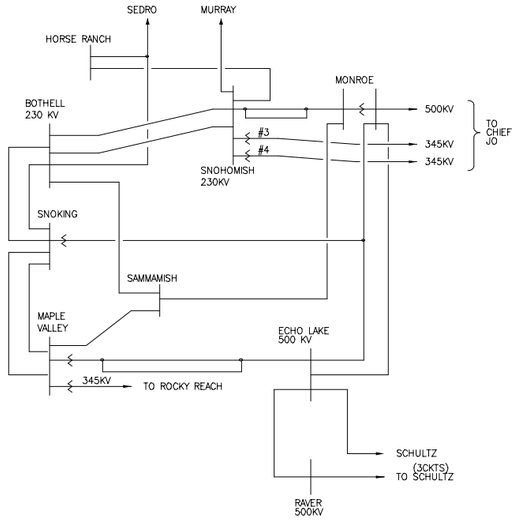
Energization Assumptions	Schultz-EchoLake 500: November 2002 Snoking 500/230 Tx: November 2002 Monroe-Echolake No.2 500: November 2002		EH WINTER (S-N)	WINTER (S-N)		SPRING (S-N)	SUMMER (N-S)	
OPTIONS	**FACILITIES REQUIRED**	PSE/SCL/SPD GENERATION	950/520/125	600/400/125	300/200/60	260/100/40	1150/650/125	1150/100/40
		REFERENCE TRANSFER LEVEL	700/1270	1270/1700	1270/1700	1370/1800	2350/2850	2350/2850
			TRANSFER DETERMINED BY INTERPOLATION. SOME OPTIONS MAY HAVE ADDITIONAL CAPABILITY.					
			INGLEDOW-CUSTER FLOW					
			(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
P41	2-Maple Valley-Snoking-Bothell 230		**1270**	**1700**	**0**	**1700**	**2850**	**2850**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN35 J06EHSN36	J06SN09 J06SN10	J06SN11 J06SN12	SPG0611 SPG0610	A6NS14 A6NS24	A6NS34W A6NS44W
	Monroe-Echolake No.2 500							
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
P42	1-Maple Valley-Snoking-Bothell 230		**0 or 1270** [7]	**0**	**0 (O/L basecase)**	**0 or 1797** [7] **(O/L basecase)**	**2850** [12]	**2850**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN37 J06EHSN38	J06SN29 J06SN30	J06SN31 J06SN32	SPG0620 SPG0621	A6NS54 A6NS64	A6NS74W A6NS84W
	Monroe-Echolake No.2 500							
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
P43 [10]	1-Maple Valley-Bothell 230		**1270**	**1700** [8,9]	**1700** [8,9]	**1700**	**2850**	**2850**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN39 J06EHSN40	J06SN111 J06SN112	J06SN113 J06SN114	SPG0630 SPG0631	A6NSG134 A6NSG144	A6NS114V A6NS124V
	Monroe-Echolake No.2 500							
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
P44	1-Maple Valley-Bothell 230		**1270** [13]	**1700** [8,9]	**1700**	**1700**	**2850**	**2850** [11]
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN46 J06EHSN47	J06SN181 J06SN182	J06SN187 J06SN188	SPG0632 SPG0633	A6NS135 A6NS145	A6NS114W A6NS124W
	Monroe-Echolake No.2 500							
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Build 12.9 mi new single circuit 230-kV from Snoking Tap to Snoking (energization: 11/02)							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							

Notes: Ambient Temperatures: -15 deg C (estimated)/-5 deg C/20 deg C/30 deg C

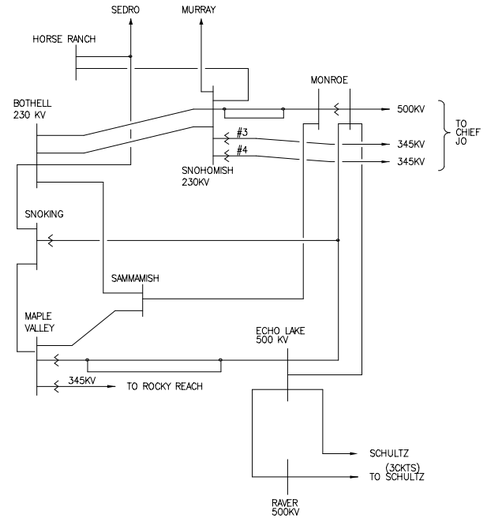
1. March PT-Pethcorn 115 @ 1190/1080/917/800 Amps (75 deg C MOT).
2. Monroe-Monroe Tap 230 @ 3000/3000/2780/2590 Amps (100 deg C MOT).
3. Monroe 500/230 Tx @ 1488/1488 (@ 0.80 L.F.)/1299/1299 MVA
4. Lakeside-Talbot #1 and #2 115 @ 1193/1080 (est.)/917/800 Amps (75 deg C MOT).
5. Cottage Brook-Duval-Stillwater-Novelty-Tolt 115 @ 479/446 (est.)/372/329 Amps (75 deg C MOT).
6. L/D Snok TP 500 and Monroe-Sammamish 230 outage considered non-credible.
7. Snoking-Bothell 230-kV line(s) tripped.
8. There may be thermal overloads on Snohomish Co. PUD 115-kV lines. Not sensitive to NI transfers.
9. Need to resolve Snohomish 115 east-bus outage. Snohomish PUD may sectionalize.
10. No other ties into Snoking except for 500-kV line.
11. Snok TP 500 and Snok TP 230 double line loss considered non-credible.
12. Beverly-Snohomish No.4 115 kV line needs to be upgraded (if not upgraded the NI limit is 2783 MW).
13. Would be limited to 700MW based on Sammamish 230/115 Tx overload caused by breaker failure at Sammamish. Beyond BPA criteria.

PUGET SOUND AREA
LONG RANGE STUDY - TRANSFER SUMMARY

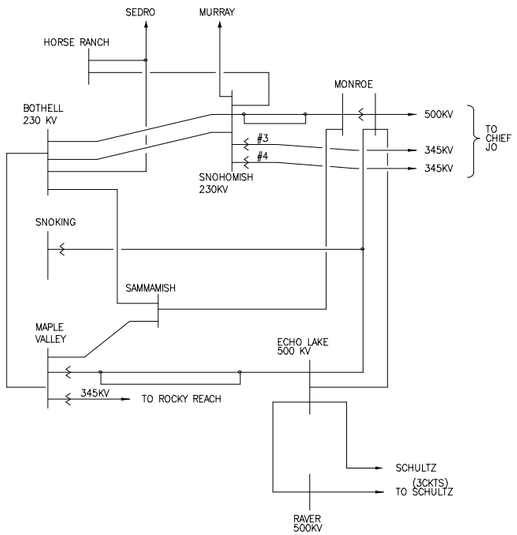
OPTION P41



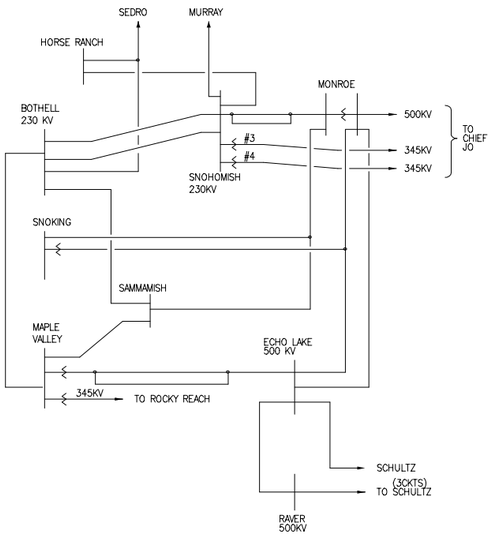
OPTION P42



OPTION P43



OPTION P44



PUGET SOUND AREA
LONG RANGE STUDY - ADDITIONAL LINE UPGRADES

OPTIONS		ADDITIONAL FACILITIES REQUIRED	EH WINTER (S-N)	WINTER (S-N)		SPRING (S-N)	SUMMER (N-S)		COMMENTS			
			950/520/125	600/400/125	300/200/60	260/100/40	1150/650/125	1150/100/40				
W1												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)					X	X				
	2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C						X				
	3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
	4	Upgrade Berrydale-Pipelake 115 to 75 deg C						X				
W2												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)						X				
	2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C						X				
	3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X	X				
	4	Upgrade Berrydale-Pipelake 115 to 75 deg C						X				
W3												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)						X				
	2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C					X	X				
	3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X	X				
	4	Upgrade Berrydale-Pipelake 115 to 75 deg C						X				
W4												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)						X				
	2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C					X	X				
	3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
	4	Upgrade Fall City-Tolt 115 kV line to 75 deg C				X						
	5	Upgrade Berrydale-Pipelake 115 to 75 deg C					X					
P41												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)					X					
	2	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
P42												
	1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)					X	X				
	2	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
P43												
	1	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C					X	X				
	2	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
P44												
	1	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C						X				
Notes:												
1. PSE MidwayP-Sweptwing 115 needs to be upgraded to 75 deg C. Load service problem for all options during summer.												
2. PSE Olympia-Olympia P No. 1 and No. 2 115 need to be upgraded to 75 deg C. Load service problems for all options during winter.												
3. Need to resolve BPA Snohomish 115-kV east bus outage. Load service problems for all options during winter.												

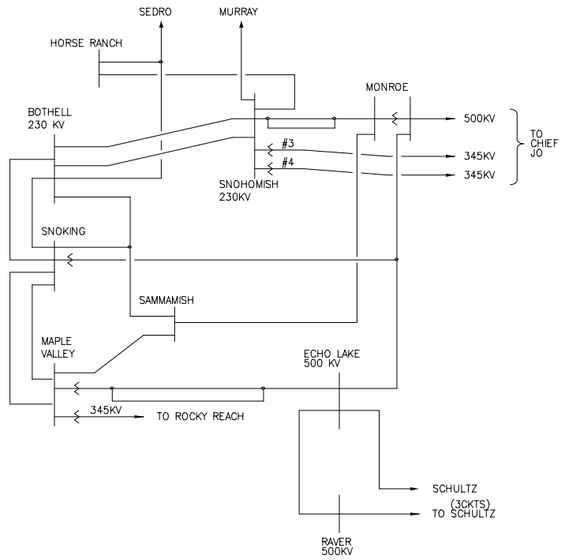
PUGET SOUND AREA
LONG RANGE STUDY - TRANSFER SUMMARY

Energization Assumptions	Schultz-EchoLake 500: November 2002 Snoking 500/230 Tx: November 2002 Monroe-Echolake No.2 500: November 2002		EH WINTER (S-N)	WINTER (S-N)		SPRING (S-N)	SUMMER (N-S)	
OPTIONS	**FACILITIES REQUIRED**	PSE/SCL/SPD GENERATION	950/520/125	600/400/125	300/200/60	260/100/40	1150/650/125	1150/100/40
		REFERENCE TRANSFER LEVEL	700/1270	1270/1700	1270/1700	1370/1800	2350/2850	2350/2850
			TRANSFER DETERMINED BY INTERPOLATION. SOME OPTIONS MAY HAVE ADDITIONAL CAPABILITY.					
			INGLEDOW-CUSTER FLOW					
			(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
W1	2-Maple Valley-Snoking-Bothell 230		**1270**	**1700**	**1344 (pf)**	**1797**	**2850**	**2850**
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN29 J06EHSN30	J06SN165 J06SN166	J06SN171 J06SN172	W1SPG01 W1SPG02	W1S01 W1S02	A6NSW11B A6NSW12B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Bothell-Sammamish 230 loop-in at Snoking. Tapping the Bothell-Sammamish 230 into Snoking Sec. 2 is preferable.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
W4	1-Maple Valley-Bothell 230		**1270** [12]	**1509** [7,8]	**821**	**1352** [10]	**2850** [11]	**2151** [9]
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN44 J06EHSN45	J06SN183 J06SN184	J06SN185 J06SN186	W4SPG01 W4SPG02	W4S01 W4S02	A6NSW42B A6NSW41B
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	No Bothell-Sammamish 230 loop-in at Snoking.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Build 12.9 mi new single circuit 230-kV from Snoking Tap to Snoking (energization: 11/02)							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							
P44	1-Maple Valley-Bothell 230		**1270** [13]	**1700** [7,8]	**1700**	**1700**	**2850**	**2850** [9]
	Schultz-EchoLake 500							
	SnoKing 500/230 Tx	Case Number →	J06EHSN46 J06EHSN47	J06SN181 J06SN182	J06SN187 J06SN188	SPG0632 SPG0633	A6NS135 A6NS145	A6NS114W A6NS124W
	Monroe-Echolake No.2 500							
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)							
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.							
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.							
	Build 12.9 mi new single circuit 230-kV from Snoking Tap to Snoking (energization: 11/02)							
	Other Miscellaneous Upgrades (see Additonal Line Upgrade spreadsheet)							

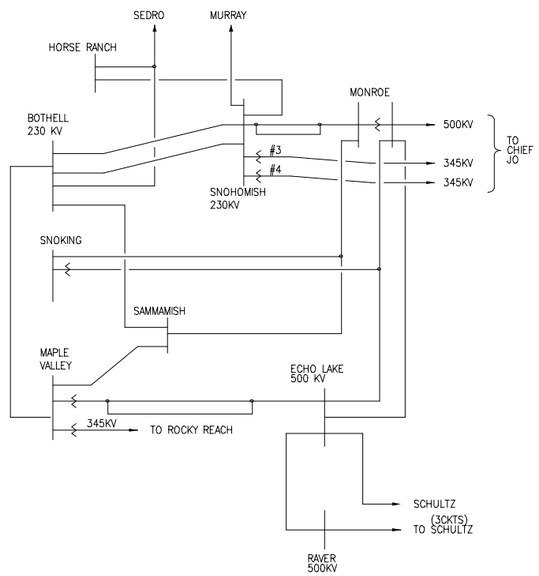
Notes: Ambient Temperatures: -15 deg C (estimated)/-5 deg C/20 deg C/30 deg C

1. March PT-Pethcorn 115 @ 1190/1080/917/800 Amps (75 deg C MOT).
2. Monroe-Monroe Tap 230 @ 3000/3000/2780/2590 Amps (100 deg C MOT).
3. Monroe 500/230 Tx @ 1488/1488 (@ 0.80 L.F.)/1299/1299 MVA
4. Lakeside-Talbot #1 and #2 115 @ 1193/1080 (est.)/917/800 Amps (75 deg C MOT).
5. Cottage Brook-Duval-Stillwater-Novelty-Tolt 115 @ 479/446 (est.)/372/329 Amps (75 deg C MOT).
6. L/D Snok TP 500 and Monroe-Sammamish 230 outage considered non-credible.
7. There may be thermal overloads on Snohomish Co. PUD 115-kV lines. Not sensitive to NI transfers.
8. Need to resolve Snohomish 115 east-bus outage. Snohomish PUD may sectionalize.
9. Snok TP 500 and Snok TP 230 double line loss considered non-credible. (For Opt. W4 if Bothell-Diablo #3 is looped into Snohomish NI limit would be 2585 MW).
10. Assumes Fall City-Tolt 115 kV line is upgraded. (If not upgraded the NI limit would be 1302 MW).
11. Loading on Bothell-Snohomish 230 kV line #2 is 99% for an outage.
12. Talbot Tx overloaded beyond emergency rating for bus outages at Maple Valley. Not sensitive to NI transfers.
13. Would be limited to 700MW based on Sammamish 230/115 Tx overload caused by breaker failure at Sammamish. Beyond BPA criteria.

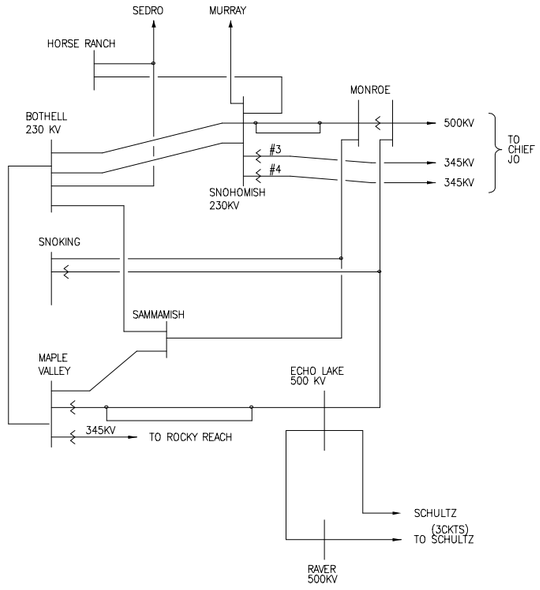
OPTION W1



OPTION P44



OPTION W4



PUGET SOUND AREA
LONG RANGE STUDY - ADDITIONAL LINE UPGRADES

OPTIONS	ADDITIONAL FACILITIES REQUIRED	EH WINTER (S-N)	WINTER (S-N)		SPRING (S-N)	SUMMER (N-S)		COMMENTS			
		950/520/125	600/400/125	300/200/60	260/100/40	1150/650/125	1150/100/40				
W1											
1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)					X	X				
2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C						X				
3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
4	Upgrade Berrydale-Pipelake 115 to 75 deg C						X				
W4											
1	Upgrade Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)						X				
2	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C					X	X				
3	Upgrade Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 to 100 deg C					X					
4	Upgrade Fall City-Tolt 115 kV line to 75 deg C				X						
5	Upgrade Berrydale-Pipelake 115 to 75 deg C					X					
P44											
1	Upgrade Snohomish-Bothell No. 2 230 to 100 deg C						X				
Notes:											
1. PSE MidwayP-Sweptwing 115 needs to be upgraded to 75 deg C. Load service problem for all options during summer.											
2. PSE Olympia-Olympia P No. 1 and No. 2 115 need to be upgraded to 75 deg C. Load service problems for all options during winter.											
3. Need to resolve BPA Snohomish 115-kV east bus outage. Load service problems for all options during winter.											

PUGET SOUND AREA
LONG RANGE STUDY - COST ESTIMATES

OPTIONS	FACILITIES REQUIRED	MILEAGE	ESTIMATES	ESTIMATED COST	COMMENTS
				($)	
W1	2-Maple Valley-Snoking-Bothell 230	Completed			
	Schultz-EchoLake 500 (tap Raver-Schultz No.2 500-kV, 3 miles from Raver). Includes Echolake substation additions.	9.5 mi	See Comments	17,780,000	LB-23460: 11,300,000 (500-kV Line) SW-7216-5: 6,480,000 (Echo Lake Term.)
	SnoKing 500/230 Tx (install in section 2)	1300 MVA w/tert.	See Comments	9,440,000	LX-20081-3: 930,000 (Move Tap) SX-22300-1: 8,510,000 (Add 500/230 Tx)
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)	14.4 mi		2,160,000	Reconductor existing 230-kV line: $150K per mile.
	Bothell-Sammamish 230 loop-in at Snoking. Tapping the Bothell-Sammamish 230 into Snoking Sec. 2 is preferable.	1-230 Term./0.75 mi	See Comments	1,000,000	Develop 1-230-kV terminal (bay 10, sec. 1): Typical: ST-5600 ($670,980) Rounded Up. ($700,000). Build 0.75 mi line: Typical: Single Ckt, Rolling Terrain, 112/04 series-Jefferson conductor. Rounded Up. ($400K/mi).
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.	1.0 mi	See Comments	400,000	Typical Estimate: Single Ckt, Rolling Terrain, 112/04 series - Jefferson conductor. Rounded up. No substation costs included.
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.			1,400,000	Assumes developing 2, 230-kV line terminals at Bothell. Typical: ST-5600 (670,980). Rounded up to $700,000/terminal.
1	Upgrade PSE Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)		See Comments	300,000	Replace 230-kV breaker. Typical Est: ST-7897 ($211,820).
2	Upgrade SCL Snohomish-Bothell No. 2 230 to 100 deg C (795 ACSR Mallard)	5.84 mi		75,000	Estimated cost per SCL. Snohomish-Bothell No. 2 230-kV
3	Upgrade PSE Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 from 75 to 100 deg C (795 ACSR Tern)	3.38mi/6.51mi/1.53mi/3.13 mi/18.61 mi		2,487,000	Beverly-Cottage Brook 115-kV (total mileage: 33.16)
4	Upgrade PSE Berrydale-Pipelake 115 to 75 deg C (250 CU 19 STR)	3.99 mi		299,250	Berrydale-Krain Corner 115-kV
W4	1-Maple Valley-Bothell 230	Completed			
	Schultz-EchoLake 500 (tap Raver-Schultz No.2 500-kV, 3 miles from Raver). Includes Echolake substation additions.	9.5 mi	See Comments	17,780,000	LB-23460: 11,300,000 (500-kV Line) SW-7216-5: 6,480,000 (Echo Lake Term.)
	SnoKing 500/230 Tx (install in section 2)	1300 MVA w/tert.	See Comments	9,440,000	LX-20081-3: 930,000 (Move Tap) SX-22300-1: 8,510,000 (Add 500/230 Tx)
	Build new single circuit 230-kV from Snoking Tap to Snoking. Install in section 1.	12.9 mi		5,160,000	Maintains second source into Snoking.
	No Bothell-Sammamish 230 loop-in at Snoking			0	
	Reconductor Bothell-Sammamish 230 (possibly with 2-Tern conductor)	14.4 mi		2,160,000	Reconductor existing 230-kV line: $150K per mile.
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.	1.0 mi	See Comments	400,000	Typical Estimate: Single Ckt, Rolling Terrain, 112/04 series - Jefferson conductor. Rounded up. No substation costs included.
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.			1,400,000	Assumes developing 2, 230-kV line terminals at Bothell. Typical: ST-5600 (670,980). Rounded up to $700,000/terminal.
1	Upgrade PSE Sammamish 230/115 No. 2 Tx bottleneck rating (breaker limitation)		See Comments	300,000	Replace 230-kV breaker. Typical Est: ST-7897 ($211,820).
2	Upgrade SCL Snohomish-Bothell No. 2 230 to 100 deg C (795 ACSR Mallard)	5.84 mi		75,000	Estimated cost per SCL. Snohomish-Bothell No. 2 230-kV
3	Upgrade PSE Beverly-Hilton Lake-OlyCanT-SW922 TAP-LK Leota-Cottage Brook 115 from 75 to 100 deg C (795 ACSR Tern)	3.38mi/6.51mi/1.53mi/3.13 mi/18.61 mi		2,487,000	Beverly-Cottage Brook 115-kV (total mileage: 33.16)
4	Upgrade Fall City-Tolt 115 kV line to 75 deg C	5.46 mi	See Comments	409,500	Upgrade existing 115-kV line: $75K per mile.
5	Upgrade PSE Berrydale-Pipelake 115 to 75 deg C (250 CU 19 STR)	3.99 mi		299,250	Berrydale-Krain Corner 115-kV
P44	1-Maple Valley-Bothell 230	Completed			
	Schultz-EchoLake 500 (tap Raver-Schultz No.2 500-kV, 3 miles from Raver). Includes Echolake substation additions.	9.5 mi	See Comments	17,780,000	LB-23460: 11,300,000 (500-kV Line) SW-7216-5: 6,480,000 (Echo Lake Term.)
	SnoKing 500/230 Tx (install in section 2)	1300 MVA w/tert.	See Comments	9,440,000	LX-20081-3: 930,000 (Move Tap) SX-22300-1: 8,510,000 (Add 500/230 Tx)
	Monroe-Echolake No.2 500 (including terminals)	30.1 mi	See Comments	64,580,000	LX-22305-1: 61,700,000 (500-kV Line) SB-22298-1: 1,180,000 (Monroe Term.) SX-22519-1: 1,700,000 (Echo Lake Term.)
	Build new single circuit 230-kV from Snoking Tap to Snoking. Install in section 1.	12.9 mi		5,160,000	Maintains second source into Snoking.
	Reterminate Horseranch Tap (Monroe-Snohomish) into Snohomish Sec. 4 Tie Monroe Tap-Snohomish #1 and #2 together.	1.0 mi	See Comments	400,000	Typical Estimate: Single Ckt, Rolling Terrain, 112/04 series - Jefferson conductor. Rounded up. No substation costs included.
	Reconductor PSE Bothell-Sammamish 230 (possibly with 2-Tern conductor)	14.4 mi		2,160,000	Reconductor existing 230-kV line: $150K per mile.
	Move Sedro-Horseranch Tap-Bothell to Bothell Sec. 5 (requires 2-PCBs). Terminate Bothell-Snoking #2 or Maple Valley-Bothell #2 into vacant bay.			1,400,000	Assumes developing 2, 230-kV line terminals at Bothell. Typical: ST-5600 (670,980). Rounded up to $700,000/terminal.
1	Upgrade SCL Snohomish-Bothell No. 2 230 to 100 deg C (795 ACSR Mallard)	5.84 mi		75,000	Estimated cost per SCL. Snohomish-Bothell No. 2 230-kV
Notes:					
1. Upgrade existing 115-kV line: $75K per mile.					
2. Reconductor existing 230-kV line: $150K per mile.					
3. Build new single circuit 230-kV: $400K per mile. Land cost not included.					
4. PSE MidwayP-Sweptwing 115 needs to be upgraded to 75 deg C (397.5 ACSR). Not sensitive to NI transfers.					
5. PSE Olympia-Olympia P No. 1 and No. 2 115 needs to be upgraded to 75 deg C (1272 AAC). Not sensitive to NI transfers.					
6. Resolve BPA Snohomish 115-kV East bus outage.					

PUGET SOUND AREA
LONG RANGE STUDY - ECONOMIC ANALYSIS

OPTION	NET PRESENT VALUE ($ x 1000)		
W1	-25,159		
W4	-28,192		
P44	-67,003		
Notes:			
1. Study Period: 20 years.			
2. Real Discount Rate: 4.75%			
3. Load Factor: 0.50			
4. Cost of Capacity: $105/kW			
5. Cost of Energy: 27mils/kW-hr			
6. Operation and Maintenance Escalation Factor: 1.7%			